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Attorneys for Plaintiffs
HOLOGIC, INC., CYTYC CORP. and HOLOGIC L.P.

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN JOSE DIVISION

HOLOGIC, INC., CYTYC CORPORATION, and HOLOGIC L.P.,

Plaintiffs,

vs.

SENORX, INC.,

Defendant.

AND RELATED COUNTERCLAIMS.

Case No. C08 00133 RMW (RS)

DECLARATION OF LYNN J. VERHEY, Ph.D. IN SUPPORT OF PLAINTIFFS' MOTION FOR PRELIMINARY INJUNCTION

Date: April 21, 2008
Time: 2:00 p.m
Room: Courtroom 6, 4th Floor
Judge: Hon. Ronald M. Whyte

I, Lynn J. Verhey, Ph.D., declare and state as follows:

1. I have been retained in this case as an expert witness by Plaintiffs Hologic, Inc., Cytyc Corporation, and Hologic L.P. I make this declaration based on my personal knowledge, training and experience, and if I were to be called to testify, I could and would testify competently about the subject matter set forth below.

2. I am presently employed by the University of California, San Francisco, as a Full Professor and I serve as Vice-Chair in the Department of Radiation Oncology. Attached to this declaration as Exhibit A is a copy of my curriculum vitae.

3. To briefly summarize my background and education, I received my B.A. in Physics from Kalamazoo College, Kalamazoo, Michigan in 1962, and my M.S. and Ph.D. in Physics in 1964 and 1968, respectively, from the University of Illinois, Urbana, Illinois. The subject of my research during my education was on the decays of certain charged particles produced by high energy interactions of protons with Hydrogen and Deuterium.

4. After earning my doctorate, I took a position at UCLA and served as a post-doctoral researcher and Assistant Professor of Physics from 1968-70, doing experiments at Lawrence Berkeley Laboratory and teaching physics to undergraduate physics students. I then moved to Harvard University in 1970 as an Assistant Professor, continuing to teach undergraduate physics and perform high energy experiments, this time at Fermi National Laboratory in Illinois.

5. In 1975 I took a position as Hospital Radiation Physicist at Massachusetts General Hospital (MGH) with a concurrent continuing position as Assistant Professor at the Harvard Medical School. I then worked with the MGH group to develop and implement proton radiation therapy as an alternative to x-ray therapy.

6. In 1990, I took the position as Chief of the Physics Division and Associate Professor in the Department of Radiation Oncology at UCSF. Since that time, I have continued to serve as Physics Chief and, in addition, as Vice-Chair of the Department and as a Full Professor. As part of my responsibilities at UCSF, I have mentored numerous graduate and post-graduate students, taught graduate classes in the Department of Bioengineering at the University of California, Berkeley as well

as at UCSF. I have taught medical physics to medical residents at UCSF as well as to physics residents. I have performed research on methods of delivering radiation to cancer patients and have published over 100 technical papers in this field.

7. I was certified as a therapeutic radiological physicist by the American Board of Radiology in 1982, appointed a fellow of the American Association of Physicists in Medicine in 2002 and a fellow of the American Society of Therapeutic Radiology and Oncology in 2006. I am a well-recognized expert in methods of delivering radiation to cancer patients, having given numerous scientific lectures and scientific meetings, both nationally and internationally.

8. I previously served as an expert witness for Cytyc Corporation in the case of *Xoft, Inc. v. Cytyc Corporation and Proxima Therapeutics, Inc.*, Case No. C05-05312 RMW, which was also pending in this Court. I understand that this case, like the *Xoft* case, involves claims of infringement of United States Patent Nos. 5,913,813 (the "813 patent") and 6,413,204 (the "204 patent"). I also understand that a third United States Patent, No. 6,482,142 (the "142 patent"), is involved in this case as well.

9. In general, the 813 patent describes and claims an invention in the field of a balloon catheter for treatment of proliferative tissue, while the 204 patent extends this concept to describe and claim as an invention a method for treatment of proliferative tissue diseases using an interstitial brachytherapy apparatus. These patents describe a catheter which can be used with an array of radiation-producing materials to irradiate the wall of a surgical cavity and a defined thickness of tissue beyond that wall, to doses that can both avoid necrosis of normal tissue and destroy cancer cells that might populate the area. The 142 patent further extends the concept of the 813 patent to describe and claim balloon catheter devices that are capable of delivering asymmetrically shaped radiation doses.

10. In connection with my role as an expert witness in the *Xoft* case, I offered this Court the following definition of a person of ordinary skill in the art, which is applicable here as well given that the same family of patents is at issue. In understanding what is taught and claimed in the 813, 204 and 142 patents, the relevant scientific area is radiation oncology physics, with a focus on brachytherapy. Typically, individuals of ordinary skill in the art of this field would hold an M.S. degree in Physics or

Engineering, with 3 or more years of clinical medical physics experience; or a Ph.D. degree in Physics or Medical Physics with 2 or more years of clinical experience.

11. Such a person would have a broad knowledge of the physics of brachytherapy procedures, of the principles of radioactivity and an understanding of the effects of radiation on cells. In addition, such a person would have an understanding of other means of treating cancer cells with radiation such as an external, gantry-mounted linear accelerator. Individuals with such qualifications are considered eligible for certification as a radiation oncology physicist by entities such as the American Board of Radiology and considered capable of working independently in a clinical environment as a medical physicist.

12. I have been asked by Plaintiffs' counsel to describe, from the viewpoint of a person of ordinary skill in the art (as defined above), what is disclosed and taught in two technical documents: (1) a 1990 article entitled "A New Technique of Brachytherapy for Malignant Gliomas with Cesium-137: A New Method Utilizing a remote Afterloading System," by Ashpole et al. (attached as Ex. 5 to the Declaration of Aaron P. Maurer) ("Ashpole"), and (2) U.S. Patent No. 5,931,774 to Williams, et al. (attached as Ex. 13 to the Declaration of Aaron P. Maurer) (the "774 patent"), entitled "Inflatable Devices for Tumor Treatment" which describes "implantable devices for treatment of proliferative disorders." I have been provided with copies of both documents and have reviewed them.

13. Ashpole describes the irradiation of a cavity from which a brain tumor has been removed, using an intracranial applicator made by modifying an endotracheal tube. In its unmodified form, the endotracheal tube has an open lumen that provides an unobstructed airway and an inflatable balloon, called a cuff, attached near its distal end that seals the space between the tube and the trachea to prevent the aspiration of unwanted matter from the pharynx into the trachea. To be used as an intracranial applicator, the endotracheal tube is shortened in length and sealed off at its distal end, just beyond the lower end of the balloon. Page 334, column 1.

14. The intracranial applicator is visually inserted into the postsurgical cavity following the removal of the brain tumor, and the balloon is then inflated with a radio-opaque fluid (needed for treatment planning purposes) so that it approximately fills the cavity. The volume of fluid used varies

according to the size of the tumor bed and the inflation is done visually prior to site closure. Page 334, column 2.

15. There is no teaching in Ashpole that the balloon can be expanded to conform the shape of the cavity to the outer surface of the balloon, or that the balloon comes into contact with the tumor bed at all points, or that the distance from the tumor bed to the radiation source can be adjusted through expansion of the balloon. Indeed, one of ordinary skill in the art would understand that undue deformation and compression of sensitive normal brain tissue caused by the influx of an incompressible fluid, are not desirable.

16. After the intracranial applicator has been implanted, it is attached to a Selectron remote afterloader, which pushes dummy sources into the tube, using positions which represent potential dwelling points for the radioactive sources during treatment. Ashpole produces a desired mean dose rate at a given distance from the balloon's surface by varying the position of active and inactive beads in the source train until an isodose curve is found, which is a satisfactory match to the cavity shape. In other words, the desired dose distribution is a direct result of the particular arrangement of active and inactive beads on a source train, and Ashpole aims to compute an isodose surface that conforms to the particular shape of the postsurgical cavity, rather than reshaping the cavity to conform to the outer surface of the balloon. Page 336, column 1 ("A certain measure of dosimetrical versatility is possible in that the positions of the active beads can be changed to produce an isodose distribution specific to the geometry of the individual tumor beds.").

17. In Ashpole the configuration of the balloon plays a role only to ensure that the dose at the prescribed depth of 0.5 cm is greater than 50% of that at the surface of the balloon. To ensure the minimum ratio, Ashpole teaches that "the balloon diameter should not be less than 2.5 cm." Page 336, column 2. Ashpole does not teach changing the balloon diameter after implantation. Rather, it prescribes a minimum diameter to which a balloon should be inflated with radio-opaque fluid during implantation.

18. Ashpole does not disclose controlling the dose at the surface of the balloon so that it is not so high that it lethally damages healthy brain cells in contact with the surface. For instance, it

indicates that "[t]he dose at the surface of the balloon . . . can be as high as 70 Gy," notwithstanding the fact that "the limited tolerance of normal brain has restricted the maximum permissible dose to about 55-60 Gy." Page 333, column 2; page 336, column 2. Furthermore, if one applies the inverse square law to Ashpole's "typical case [of] a balloon diameter of 2.9 cm," then a depth dose of 50Gy at 0.5 cm from the surface of the balloon would mean a dose of approximately 90 Gy at the surface, assuming a symmetric distribution of sources within the balloon. Ashpole's teaching of a minimum balloon diameter of 2.5 cm suggests that for a dose of 50Gy at 0.5 cm from the cavity surfact, that the dose at the surface can be even higher than 90 Gy.

19. Ashpole explains that the intracranial applicator avoids the problem of late or delayed radionecrosis observed with the use of long-term wire implants because the intracranial applicator is removable and implanted into an area from which the tumor has already been debulked. Page 336, column 2.

20. The 774 patent discloses an implantable balloon applicator for delivering one or more treatment fluids to target tissue. Although it discusses several embodiments, the one of particular interest is a "double balloon device" with an outer and inner balloon, as depicted in Figure 3.

21. The 774 patent teaches that "it is preferable that the balloon have a shape that permits the balloon to conform to the body cavity or lumen in which the balloon is to be inflated." Column 7, lines 41-43. Furthermore, "[i]n certain embodiments, a balloon will be selected such that, upon inflation, the balloon does not compress the tissue which is being treated, or surrounding tissues. Thus, when a radioactive treatment fluid is introduced into the device, e.g., by injection, the treatment device is inflated to a volume not substantially greater than a volume of the body cavity in which the device has been placed, thereby avoiding any substantial compression or distortion of normal tissue." Column 7, lines 48-56. This is consistent with the disclosure in Ashpole, in which the applicator balloon, because it is being used within the brain, is inflated with fluid to a volume only sufficient to fill the postsurgical cavity in which the device has been placed but not to cause any compression or deformation of the surrounding brain tissue.

22. The double balloon device of Figure 3 is shown as having two treatment fluid receptacles, one in communication with the outer balloon and the other one in communication with the inner balloon. Column 8, lines 41-46 and 54-60. The outer balloon in this example is filled with a chemotherapeutic fluid and the inner balloon is filled with a radioactive fluid. Column 8, lines 60-65.

23. Although Figure 3 shows the inner balloon as having an off-center position relative to the outer balloon, this is a schematic view only and not something drawn to scale. Column 3, lines 1-2. Accordingly, the degree to which the inner balloon occupies an asymmetric position relative to the outer balloon, which is not mentioned or discussed at all in the 774 patent, cannot be determined. It would depend on the device's actual design and construction.

24. More importantly, neither Figure 3 nor the specification of the 774 patent teaches a person of ordinary skill in the art how the radiation source in the inner balloon can be *located and arranged* to provide *predetermined* asymmetric isodose curves relative to the outer balloon. If the inner balloon has an asymmetry relative to the outer balloon, that asymmetry is fixed by the geometric constraints of the device, and therefore the position of the inner balloon cannot be altered to provide predetermined asymmetric isodose. Instead, any asymmetric dose distribution produced by the radioactive fluid in the inner balloon would be a byproduct of the inner balloon's inherent asymmetry.

25. In addition to the *Xoft* case mentioned above, for which I provided both deposition and hearing testimony, I provided testimony as an expert at a deposition in the case of *Maggiani vs. University of Southern California* conducted on February 20, 2006.

26. I am being compensated for my work on this matter at a rate of $500 per hour. My compensation does not depend on the outcome of this case.

I declare that the foregoing is true and correct to the best of my knowledge under penalty of perjury.

Executed on April _3__, 2008 in San Francisco, California.

Lynn J. Verhey, Ph.D.

Exhibit A

University of California, San Francisco **Updated: 5/10/07**

CURRICULUM VITAE

Name: **Lynn J. Verhey**

Position: Professor in Residence, Step 6
Department of Radiation Oncology
School of Medicine

Faculty Member, Bioengineering Graduate Group

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San Francisco, CA 94143-1708

Voice: (415) 353-7184
FAX: (415) 353-7182
email: verhey@radonc17.ucsf.edu

EDUCATION:

1958-62	Kalamazoo College, Kalamazoo, MI	BA	Physics, Cum Laude
1962-64	University of Illinois, Urbana, IL	MS	Physics
1964-67	University of Illinois, Urbana, IL	PhD	Physics

BOARD CERTIFICATION:

1982 American Board of Radiology (Therapeutic Radiological Physics)

PRINCIPAL POSITIONS HELD:

1967-70	University of California, LA	Assistant Professor	Physics
1971-72	Harvard University	Lecturer	Physics
1972-75	Harvard University	Assistant Professor	Physics
1975-90	Harvard Medical School	Assistant Professor	Radiation Therapy
1991-96	University of California, SF	Assoc. Professor in Residence	Radiation Oncology
1996-now	University of California, SF	Professor in Residence	Radiation Oncology

OTHER POSITIONS HELD CONCURRENTLY:

1975-78	Massachusetts General Hospital	Assistant Biophysicist	Radiation Medicine
1978-90	Massachusetts General Hospital	Associate Biophysicist	Radiation Medicine
1978-90	Massachusetts General Hospital	Head, Clinical Physics	Proton Therapy

1991-now	University of California, SF	Chief of Physics	Radiation Oncology
1991-now	University of California, SF	Vice-Chair	Radiation Oncology
1991-00	University of California, SF	Faculty	Graduate Group in Biophysics
1994-now	UCSF and UC Berkeley	Faculty	Bioengineering Graduate Group

HONORS AND AWARDS:

1962	Phi Beta Kappa, Kalamazoo College
1962	John Wesley Hornbeck Prize in Physics, Kalamazoo College, Kalamazoo, MI
2002	Fellow, American Association of Physicists in Medicine
2006	Fellow, American Society of Therapeutic Radiation and Oncology

KEYWORDS/AREAS OF INTEREST:

Radiotherapy, intensity modulation, protons, radiosurgery, ocular melanoma, dosimetry, image-guided radiotherapy, magnetic resonance spectroscopy, cancer of the prostate, head and neck and brain.

PROFESSIONAL ACTIVITIES

CLINICAL:

Head of clinical physics from 1978-90 for the proton radiation treatment program of the Department of Radiation Therapy, Massachusetts General Hospital.

Director of Physics for Gamma Knife Facility, University of California, San Francisco since 1991

Director of Physics for ocular melanoma proton treatment facility University of California, San Francisco and University of California, Davis since 1994

Implementation and direction of intensity modulated radiotherapy treatments at UCSF since 1997

Specification and oversight for acquisition, installation, commissioning and operation of $20 million state-of-the-art Radiation Oncology Department at UCSF Comprehensive Cancer Center at Mount Zion from 1998 to present

SUMMARY OF CLINICAL ACTIVITIES

As Chief of Physics in the Department of Radiation Oncology at UCSF, I am responsible for all technical aspects of the planning and delivery of sophisticated precision radiotherapy and radiosurgery. This includes supervision and oversight of approximately 20 radiation therapists, six dosimetrists, two engineers and eight physicists. I provide oversight and direction to the physics faculty in their clinical service and in the development of new clinical delivery schemes and imaging methods. As Director of Physics for the Gamma Knife, I coordinate and oversee quality assurance of treatments, safety and radiation training of all personnel, new upgrades of software and hardware and the installation of new radiation sources.

PROFESSIONAL ORGANIZATIONS:

Memberships

1962	Phi Beta Kappa
1966	Sigma Pi Sigma
1975-80	American Association of Physics Teachers
1976-now	American Association of Physicists in Medicine
1979-now	American Society of Therapeutic Radiologists
1979-99	Radiation Research Society
1983-90	American Association for the Advancement of Science
1984-now	Proton Therapy Cooperative Group
1986-90	New York Academy of Science
1992-now	International Stereotactic Radiosurgery Society
1995-now	California Radiological Society
1995-now	American College of Radiology

Service to Professional Organizations

1991-97	Chairman of Quality Assurance Committee of Proton Radiation OncologyGroup Sponsored by American College of Radiology
1992-99	Member, RTOG Committee on Quality Assurance in Conformal Radiation Therapy (3D-CRT)
1992-97	Member, Radiation Physics Committee of American Society for Therapeutic Radiology and Oncology (ASTRO)
1992-93	Member, Research Committee, American Association of Physicists in Medicine (AAPM)
1993-95	Reviewer for Awards and Honors Committee of AAPM
1993-now	Reviewer of abstracts for Annual meeting of AAPM
1993-03	Reviewer of abstracts for Annual Meeting of ASTRO
1994	Reviewer of abstracts for 1994 Annual Meeting of the Radiological Society of North America (RSNA)
1995-now	Member, Committee on Quality Assurance for Cooperative Clinical Trials, a Subcommittee of the Radiation Therapy Committee of the AAPM
1996-01	Member, Committee on Membership of ASTRO
1996-01	Member, 3D Committee of the Radiation Therapy Oncology Group (RTOG)
2000-02	Member, Awards Committee of ASTRO
2003-now	Member, Corporate Working Group of ASTRO

SERVICE TO PROFESSIONAL PUBLICATIONS

1998-now	Editorial Board, International Journal Radiation Oncology, Biology and Physics (IJROBP)
1988-now	Ad hoc referee for IJROBP (10 papers in past 5 years), Medical Physics (5 papers in past 5 years), British Journal of Radiology (2 papers in past 5 years), Radiotherapy and Oncology (2 papers in past 5 years), Physics in Medicine and Biology (8 papers in past 5 years)

INVITED PRESENTATIONS (PAST 15 YEARS)

INTERNATIONAL

1991	International Workshop on Heavy Charged Particle Therapy and Related Subjects, National Institute for Radiological Sciences, Chiba, Japan
1991	World Congress on Medical Physics and Biomedical Engineering, Kyoto, Japan
1993	International Leksell Gamma Knife Society Meeting, Aronsborg, Sweden
1993	International Symposium on 3D Radiation Treatment Planning and Conformal Therapy, St. Louis, MO
1994	Proton Therapy Cooperative Group Meeting, Chester, England
1994	Proton Therapy Cooperative Group Meeting, Chiba, Japan
1995	Siemens Vision Group on New Directions in Radiotherapy, Frankfurt, Germany
1995	Annual Meeting of the International Commission on Radiation Units and Measurements (ICRU) in Remsheid-Lennep, Germany
1995	US-Japan Radiation Oncology Meeting, San Francisco, CA
1995	International Stereotactic Radiosurgery Meeting, Boston, MA
1997	XII International Conference on the Use of Computers in Radiation Therapy, Salt Lake City, Utah
1997	First Professor S. Takahashi Memorial International Workshop on Three Dimensional Conformal Radiotherapy, Nagoya, Japan
1997	Siemens Therapy Products Enduser Meeting and Seminar, Beijing, China
1997	International Congress of Radiation Oncology, Beijing, China
1997	Third Congress of the International Stereotactic Radiosurgery Society, Madrid, Spain
1997	ESTRO Workshop on Challenges in Conformal Radiotherapy, Nice, France
1998	DKFZ (Deutsche Krebs Forschung Zentrum), Heidelberg, Germany
1998	3rd International Symposium on 3-D Radiation Treatment Planning and Conformal Radiotherapy, Chapel Hill, NC
1998	Second Professor S. Takahashi Memorial International Workshop on Three Dimensional Conformal Radiotherapy, Nagoya, Japan
1999	International Stereotactic Radiosurgery Society (ISRS) Meeting, Sydney, Australia
1999	Annual Meting of Societe Francaise De Radiotherapie Oncologique, Paris, France
2000	2nd Annual Wharton Lecture, Princess Margaret Hospital, Toronto, Canada
2000	Hallym Hospital, Seoul, Korea
2000	Samsung Hospital, Seoul, Korea
2000	Addenbrookes Hospital, Cambridge, England
2000	Annual Meeting of the European Society for Therapeutic Radiology and Oncology (ESTRO), Istanbul, Turkey
2000	First International Symposium on Stereotactically Guided IMRS/IMRT, Los Angeles, CA
2001	International Congress on Radiation Oncology (ICRO), Melbourne, Australia
2001	Sun-Yat-Sen Cancer Center, Taipei, Taiwan
2001	Third Professor S. Takahashi Memorial International Workshop on Three Dimensional Conformal Radiotherapy, Nagoya, Japan
2002	Leksell Gamma Knife Society Meeting, Prague, Czech Republic
2002	Hospital Sirio Libanes, Sao Paulo, Brazil

2002 Joint Meeting Canadian Organization of Medical Physicists and American Association of Medical Physicists, Montreal, Canada
2003 NZIMRT Annual Conference, Hamilton, New Zealand
2003 Organizer, Moderator and Speaker, 7th International Conference on 3DCRT/IMRT, San Francisco, CA
2003 2nd International Conference on Translational Research and Pre-Clinical Strategies in Radio-Oncology, Lugano, Switzerland
2004 Fourth Professor S. Takahashi Memorial International Workshop on Three Dimensional Conformal Radiotherapy, Nagoya, Japan

NATIONAL

1992 Special Focus Panel at Annual Meeting of Radiological Society of North America, Chicago, IL:
1993 Special Panel on Conformal Therapy at the Annual Meeting of the American Society for Therapeutic Radiation and Oncology, New Orleans, LA
1994 Preuss Foundation Seminar on Stereotactic Radiation Treatment of Brain Tumors, Boston MA
1995 Special Workshop at the Annual Meeting of the Radiation Research Society on "New Methods of Delivering Radiation Therapy", San Jose, CA
1995 Symposium on Implementation of Emergent Technology in Radiation Oncology, Indian Wells, CA
1995 Scientific Session of the Radiation Therapy Oncology Group Annual Meeting, Philadelphia, PA
1996 Workshop on Intensity Modulated Radiation Therapy, Durango, CO
1996 Radiation Therapy Oncology Group Annual Meeting, Washington, DC
1997 Visiting Professor, Duke University Medical Center, Department of Radiation Oncology Grand Rounds, Durham, NC
1997 14th Annual Meeting of the American College of Medical Physics, Lake Tahoe, CA
1998 20th Annual Engineering Industrial Liaison Program, University of Calif., Berkeley, CA
1998 Intensity Modulated Radiation Therapy Workshop, Williamsburg, VA
1998 Annual Meeting of the American Association of Physicists in Medicine (AAPM), San Antonio, TX
1999 Radiation Therapy Oncology Group (RTOG) Annual Meeting, Atlanta, GA
1999 3-D Meeting on Conformal and Intensity Modulated Radiation Therapy, Houston, TX
1999 Annual Meeting of AAPM, Nashville, TN
1999 National Cancer Institute Workshop on Medical Physics for Clinical Radiotherapy, Washington, DC
1999 Annual Meeting of the American Association of Therapeutic Radiology and Oncology (ASTRO), San Antonio, TX
2000 3-D Conformal Radiotherapy Workshop, New York, NY
2000 Combined Meeting of World Congress of Medical Physicists and AAPM, Chicago, IL
2000 Annual Meeting of ASTRO, Boston, MA
2000 Siemens Users' Meeting, Kiowah Island, SC
2001 International Stereotactic Radiosurgery Society (ISRS), Las Vegas, NM
2001 Annual Meeting of AAPM, Salt Lake City, UT

2001 Visiting Professor, Symposium Honoring the Career of Dr. Michael Goitein at Massachusetts General Hospital, Boston, MA
2002 Visiting Professor, Department of Radiation Oncology, University of Pennsylvania, Philadelphia, PA
2002 Annual Meeting of ASTRO, New Orleans, LA
2003 Annual Meeting of ASTRO, Salt Lake City, UT
2003 Organizer, Moderator and Speaker, Proton Therapy Cooperative Group Meeting, San Francisco, CA
2003 Siemens Users' Meeting, Salt Lake City, UT
2004 Annual Meeting of AAPM, Pittsburgh, PA
2004 Annual Meeting of ASTRO, Atlanta, GA
2004 Annual Meeting of American Association of Physics Teachers, Sacramento, CA

REGIONAL AND OTHER INVITED PRESENTATIONS

1991 Cancer Education Session, Stanford University Department of Radiation Oncology, Stanford, CA
1993 Department of Physics, Sonoma State University, Rohnert Park, CA
1993 Bay Area Chapter of the American Association of Neuroscience Nurses
1994 Grand Rounds, Department of Radiation Oncology, UCSF
1994 29th Annual San Francisco Cancer Symposium, San Francisco, CA
1995 15th Annual Current Approaches to Radiation Oncology, Biology and Physics, San Francisco, CA
1996 Northern California Society of Radiation Therapy Technologists, Concord, CA
1997 16th Annual Current Approaches to Radiation Oncology, Biology and Physics, San Francisco, CA
1997 Annual Retreat of the Graduate Group in Biophysics, UCSF, Tiburon, CA
1998 17th Annual Current Approaches to Radiation Oncology, Biology and Physics, San Francisco, CA
1999 18th Annual Current Approaches to Radiation Oncology, Biology and Physics, San Francisco, CA
1999 First Annual Radiosurgery Symposium, UCSF
2001 Stanford University IMRT Symposium, Palo Alto, CA
2002 Cyberknife Users' Meeting, Napa, CA
2002 Siemens Users' Meeting, Santa Rosa, CA
2002 UCSF-Stanford Post-Graduate Course – Scientific Program Coordinator and Moderator
2002 Joint Meeting of SFSU-UCSF U56 Collaborative Advisory Committee
2003 UCSF-Stanford Post-Graduate Course – Scientific Program Coordinator and Moderator

GOVERNMENT AND OTHER PROFESSIONAL SERVICE:

1990-97 Chair, Report Committee on Proton Therapy, International Commission on Radiation Units and Measurements (ICRU)
1990-91 Loma Linda University Medical Center: Safety Review Committee on the Proton Therapy Facility
1992-93 Lawrence Berkeley Laboratory, University of California, Berkeley: Dosimetry Review Committee for Heavy Ion Radiotherapy Program

1992	Lawrence Berkeley Laboratory, University of California, Berkeley: Research Medicine and Radiation Biophysics Division Review Committee
1992-93	National Cancer Institute: Program Project Scientific Review Panel
1993	National Cancer Institute: Review Committee for Radiological Physics Center at M.D. Anderson Hospital, Houston, TX
1993-95	Nuclear Regulatory Commission and Lawrence Livermore National Laboratory: Reviewer of Quality Management Plans
1995	TRIUMF and the British Columbia Cancer Agency: Safety Review Committee on the Proton Therapy Facility
1996	National Cancer Institute: Member, Special Review Committee for Program Project at University of Michigan Medical Center
1997-04	Takahashi International Workshop Organizing Committee, Nagoya, Japan
1997-01	National Cancer Institute: Member, Special Ad Hoc Review Committee of the Radiation Studies Section of NCI
1999	External Physics Consultant to Swedish Hospital, Seattle, WA
1999	External Advisor to University of Texas Medical Branch, Galveston, TX
1999-01	National Cancer Institute: Member, Intensity Modulated Radiotherapy Cooperative Working Group
2000	National Cancer Institute: Member, Special Review Committee for Program Project at University of Michigan Medical Center
2000-03	Cancer Research Coordinating Committee of State of California: Reviewer of Research Proposals
2001	Special Advisor to Department of Radiation Oncology, Princess Margaret Hospital, Toronto, Canada
2004	Special Ad Hoc Reviewer of Research Proposal for the Dutch Cancer Society

UNIVERSITY AND PUBLIC SERVICE

UNIVERSITY SERVICE:

UCSF, UC BERKELEY AND UC DAVIS CAMPUS-WIDE

1991-00	Faculty member of the Graduate Group in Biophysics, University of California, San Francisco
1991-93	Member, University of California, Davis Cancer Center Proton Beam Task Force and Clinical Specifications Subcommittee
1992-03	Chair, Radiation Drug Research Committee, University of California, San Francisco
1992-03	Member, Radiation Safety Committee, University of California, San Francisco
1993-95	Member, Environmental Health and Sciences Advisory Group, University of California, San Francisco
1994	Chair, Ad Hoc Promotion Review Committee, University of California, San Francisco
1994	Founding Member, UCSF Cancer Center
1994-now	Faculty member of Bioengineering Graduate Program, University of California, Berkeley
1997-00	Member, Health and Safety Policy Board of the University of California, San Francisco
1998,99,02	Member Ad Hoc Promotion Review Committees, University of California, San Francisco
1998	Vice-Chair, Admissions Committee of the Bioengineering Graduate Program, University of California, Berkeley
1998-now	Specification and oversight for acquisition, installation, commissioning and operation of $20 M state-of-the-art Radiation Oncology Department at UCSF Comprehensive Cancer Center at Mount Zion
1999	Chair, Admissions Committee of the Bioengineering Graduate Program, University of California, Berkeley
2000-03	Member, Graduate Council of the Academic Senate, University of California, San Francisco
2001-now	Member, UCSF Health and Safety Policy Board
2001-03	Member, Bioengineering Graduate Group Executive Committee
2001-02	Member, Academic Senate Subcommittee on Creation of a UCSF School of Advanced Health Studies
2003-now	Member, Bioengineering Graduate Group Advisors' Committee
2002-03	Service on Qualifying and Final Exam Committees for Bioengineering Grad. Students
2004-	Member, Educational Policy Committee of the Academic Senate, UCSF

DEPARTMENTAL SERVICE

1991-now	Vice Chair and Chief of Physics
1991-now	Member, Internal Computer Committee
1991-now	Member, External Computer Committee
1991-now	Member, Program Committee of Annual Course on Current Approaches to Radiation Oncology, Biology and Physics

1991-94	Member, Mt. Zion -University of California, San Francisco Radiation Oncology Integration Committee
1991-now	Member, Quality Assurance / Quality Improvement Committee
1991-now	Member, Radiation Oncology Research Allocation Committee
1991-now	Member, Radiation Oncology Resident Selection Committee
1991-now	Member, Executive Committee of Department of Radiation Oncology
1993-94	Chair, Faculty Search Committee for Physics Faculty in Hyperthermia
1993-now	Initiator and Director, Physics Residency Training Program in Therapeutic Radiation Oncology Physics
1996	Member, Faculty Search Committee for Assistant Professor in Residence with Combined Research/Clinical Duties
1997	Chair, Ad Hoc Committee for Selection of NOMOS Medical Research Fellow for Clinical Implementation of Intensity Modulated Radiation Therapy
1997	Member, Faculty Search Committee for Wun-Kon Fu Endowed Chair in Radiation Oncology
1998	Member, Senior Promotions Committee
1998	Chair, Ad Hoc Committee for Selection of Siemens Medical Research Fellow
1998	Chair, Faculty Search Committee for Assistant Professor in Residence (Physics)
2001-now	Member, Radiation Oncology Animal Care Review Committee

PUBLIC SERVICE:

1990	Member of scientific delegation for US-Soviet Union Proton Therapy Exchange Program
1993-98	Member, Medical Physics Advisory Committee (MEDPAC), Lawrence Livermore National Laboratory
1998	Scientific American Interview with W. Wayt Gibbs
1998	Wired Magazine Interview with Heidi Kriz
2000-03	Scientific Advisory Board, Accuray, Inc.
2001-04	Scientific Advisory Board, MED-TEC, Inc.

SUMMARY OF SERVICE ACTIVITIES

Most of my service activities in the past five years have been associated with administrative duties within the Department of Radiation Oncology, campus-wide committees, and activities within the cross-campus Bioengineering Graduate Group, where I am an active faculty member. As a member of the executive committee of the Department of Radiation Oncology, I am involved in all decisions relating to finances, promotions and salaries, and space allocation. As the Chief of the Physics Division within the department, I have special mentoring and advising duties for the other physics faculty as well as technical supervision of engineers, dosimetrists and radiation therapists. As Director of the Physics Residency Training Program, I have major responsibilities to select, mentor and advise the residents in their clinical training program. As a member of the Medical Residency Selection Committee, I work with a small group of department faculty to interview and rank resident candidates. As a member of the Program Committee of the Annual UCSF-Stanford Post-Graduate Course on Current Approaches to Radiation Oncology, Biology and Physics, I am responsible for planning and arranging the physics and technical presentations. As a long-standing member of the Radiation

Safety Committee of the campus until 2003, I was one of several members responsible for investigating and analyzing the use of radioactivity in research and in clinical activities. As a member of the Scientific Advisory Board of two vendors of medical equipment used in Radiation Oncology, I have been able to influence the development of devices that improve the quality of patient care.

TEACHING and MENTORING

FORMAL SCHEDULED CLASSES FOR UCSF AND UCB STUDENTS:

Qtr	Acad. Yr	Course No. & Title	Contribution	Units	Class Size
F,W	1998-99	Medicine 424 Therapeutic Radiological Physics	Lecturer	1	5
F,W	1999-00	Medicine 424 Therapeutic Radiological Physics	Lecturer	1	5
F,W	2000-01	Medicine 424 Therapeutic Radiological Physics	Lecturer	1	5
F,W	2001-02	Medicine 424 Therapeutic Radiological Physics	Lecturer	1	5
F,W	2002-03	Medicine 424 Therapeutic Radiological Physics	Lecturer	1	5
F,W	2003-04	Medicine 424 Therapeutic Radiological Physics	Lecturer	1	5
F	2000-01	NE 167 Engineering Aspects Nuc Med / RadioTherapy	Course Design and Lecturer	3	10
S	2001-02	Bioeng. 230C Physics of Radiation Oncology	Course Design and Lecturer	3	5
S	2003-04	Bioeng 230C Physics of Radiation Oncology	Course Design and Lecturer	3	8
S	2005-06	Bioeng 230C Physics of Radiation Oncology	Course Design and Lecturer	3	4

POSTGRADUATE AND OTHER COURSES

2003 7th International Conference on 3DCRT/IMRT, San Francisco, Organizer, Moderator and Speaker

2002-05 UCSF-Stanford Post-Graduate Course on Radiation Oncology – Scientific Program Coordinator, Moderator and Speaker

2002-06 Gamma Knife Model C training for outside clinicians and physicists

PREDOCTORAL STUDENTS SUPERVISED OR MENTORED

Dates	Name	Program or School	Role	Current Position
1998-99	Nkiruka Emeagwali	Johns Hopkins	Research advisor	Graduate Student
1998-00	Gordon Wong	Bioengineering, UCB	Research advisor	Graduate Student
1999-02	Ted Graves	Bioengineering, UCSF	Research co-mentor	Asst. Prof. Stanford

2000	Andrew Hwang	Bioengineering, UCSF	Rotation coordinator	Graduate Student
2001-02	Richard Cardenas	Texas Tech University	Research co-mentor	Asst Prof St. Marys TX
2003-	Michael Lometti	SFSU MS student	Research co-mentor	Research Associate
2004-	Erica Ludlam	Bioengineering, UCSF	Research co-mentor	Graduate Student
2003-	Olivier Morin	Bioengineering, UCSF	Research co-mentor Academic advisor	Graduate Student
2002-04	Annette A. Chan	Bioengineering, UCSF	Research co-mentor Academic advisor	Post-doctoral Researcher
2004-	Cornelius VonMorze	Bioengineering, UCSF	Academic advisor	Graduate Student

POSTDOCTORAL FELLOWS AND RESIDENTS DIRECTLY SUPERVISED OR MENTORED

Dates	Name	Fellow/Resident	Faculty Role	Current Position
1992-95	Su-Min Zhou	Physics Res. Fellow	Research Advisor	Assoc. Prof. Duke
1993-95	Bruce Hill	Physics Resident	Clinical Training	Physicist - Stanford
1994-95	Tibor Major	IAEA Physics Fellow	Research Advisor	Physicist – Hungary
1994-98	Inder Daftari	Hospital Physicist	Clinical Training	Hospital Physicist UCSF
1994-96	Greg Bednarz	Physics Resident	Clinical Training	Physicist– U. Penn
1995-97	Ping Xia	Physics Resident	Clinical Training	Assoc. Prof. UCSF
1998-00	Michelle Svatos	Physics Res. Fellow	Research Advisor	Physicist - Siemens
1996-98	Jenny Hai	Physics Resident	Clinical Training	Physicist- Stanford
1997-99	D Jay Wieczorek	Physics Resident	Clinical Training	Physicist – Baptist Hosp. Miami
1998-00	Lei Wang	Physics Resident	Clinical Training	Asst Prof Sequoia Hosp
1999-02	Cynthia Chuang	Physics Resident	Clinical Training	Clin. Instructor UCSF
1999-01	Andrea Pirzkall	Research Fellow	Research Supervision	Asst. Adj. Prof. UCSF
2000-03	Katja Langen	Physics Resident	Clinical Training	Physicist – MD Anderson Orlando
2000-01	Khalil Sultanem	Clinical Fellow	Research Supervision	Attending Physician
2002-04	Jose-Eduardo Villarreal	Physics Resident	Clinical Training	Physicist - Mount Diablo Hospital
2001-02	Jean Nakamura	Rad. Onc. Resident	Research Supervision	Instructor, UCSF
2002-05	Ningsheng Zhu	Physics Resident	Clinical Training	Physics Resident
2003-07	Josephine Chen	Research Fellow and Physics Resident	Research and Clinical Training	Research Fellow and Resident

2003-05	Hong Chen	Physics Resident	Clinical Training	Physics Resident
2005-07	Martina Descovich	Physics Resident	Clinical Training	Physics Resident
2007-09	Tarek Halabi	Physics Resident	Clinical Training	Physics Resident

RADIATION ONCOLOGY RESIDENTS AND FELLOWS – CLINICAL INSTRUCTION

1989-92	Marquez, Carol	Levin, Ken	Stalpers, Lucas
	Bahary, Jean-Paul	Garwood, Dan	Levine, Rene
	Uhl, Valerie	Miyawaki, Lloyd	Schoenthaler, Robin
	Stalpers, Lucas	Eng, Tony	Scharfen, Cindy
	Feehan, Patrick	Lillis, Patricia	Weil, Michaei
	Gotkowitz, Carrie	Chang, Garrick	Hunter, Darryl
1992-95	Holland, John	Yates, Barbara	Maloney, Alan
	Goldsmith, Brian	Schrieve, Dennis	Ling, Stella
	Diaz, Aidnag	Tran, Loan	Schultz, Marion
1995-99	Crownover, Richard	Bermudez, Maria-Amelia	Koeplin, David
	Haas-Kogan, Daphne	Bauman, Glenn	Coleman, Lori
	Chou, Rachel	Chen, Anita	Shu, Hui-Kuo
	Le, Quynh-Thu	Forstner, Julie	Song, Joseph
1999-01	Seung, Steven	Coleman, Cardella	Seaward, Samantha
	Posner, Marc	Gottschalk, Alex	Hoffman, Rex
2001-03	Suplica, Jeffrey	Vigneault, Eric	Bertucio, Clare
	Fisch, Ben	Lee, Terry	Tsao, May
	Sultanem, Khalil	Young, C. Dale	Biggs, Christopher
	Nakamura, Jean Lee	Takamiya, Robert	Lowther, David
2003-present	Stickney, Eric	Doyle, Kelly	Huang, Kim
	Ho, Linh	Huang, David	Rembert, James
	Missett, Brian	Coleman, Joy	Millender, Laura
	Chen, Allen	Dai, Charlotte	Hansen, Eric
	Lee, Brian		

INFORMAL TEACHING:

1991-07 Teaching Gamma Knife planning to residents, fellows and faculty
1991-07 In-service lectures on radiosurgery, IMRT and clinical physics

FACULTY MENTORING

Dates	Name	Position while Mentored	Mentoring Role	Current Position
1994-96	Paula Petti	Asst. Professor	Academic and research advisor	Adjunct Professor UCSF
1998-02	Ping Xia	Clinical Instructor	Academic and research advisor, reviewed grant proposal	Associate Professor in Residence, UCSF
2002-now	Cynthia Chuang	Clinical Instructor	Academic and research advisor	Asst. Adjunct Professor, UCSF
2003	Bruce Faddegon	Associate Professor	Reviewed grant proposal	Associate Professor, UCSF
2001-04	Andrea Pirzkall	Assistant Researcher	Reviewed manuscripts, academic advisor	Associate Professor, UCSF
2006-07	Lijun Ma	Associate Professor	Reviewed manuscripts and mentored research	Associate Professor, UCSF

SUMMARY OF TEACHING HOURS:

2002-03 305 total hours of teaching (including preparation)
Formal class or course teaching hours: 25 hours
Informal teaching hours: 250 hours
Mentoring: 30 hours

2003-04 390 total hours of teaching (including preparation)
Formal class or course teaching hours: 80 hours
Informal teaching hours: 280 hours
Mentoring: 30 hours

2004-05 335 total hours of teaching (including preparation)
Formal class or course teaching hours: 30 hours
Informal teaching hours: 280 hours
Mentoring: 25 hours

TEACHING NARRATIVE:

My teaching hours are divided between formal courses, including a quarter course (Bioengineering 230C) recently introduced by me to offer the Physics of Radiation Oncology as a subject. From this course, several graduate students have become interested in research in the physics of Radiation Oncology and are now doing rotations or beginning thesis research in our group. As director of the Physics Residency Training Program, I have been responsible for designing the curriculum, selecting the residents and assuring their progress through the clinical training. Two of the graduates of this program have stayed to become faculty in our Department. As Chief of Physics, I am responsible for the physics education of the medical residents. I have also taken responsibility for mentoring new faculty in the Physics Division as well as clinical physics instruction for new medical faculty. In summary, it is my responsibility to educate all faculty and staff in the physics of Radiation Oncology.

RESEARCH AND CREATIVE ACTIVITIES

RESEARCH AWARDS AND GRANTS

CURRENT

U56 Minority Institution/Cancer Center Partnership — 04/01/02-03/31/07
Cancer Training and Career Development — $2,500,000 direct
NIH/NCI (PI: Macher)

Siemens – UCSF Research Collaborative Agreement — 10/01/05-09/30/07
Research on Portal Imaging and Intensity Modulation — $390,000 direct
Siemens Oncology Systems (PI: Verhey)

PENDING

Radiosurgical Treatment of Temporal Lobe Epilepsy
NIH/NINDS (PI: Barbaro)

PAST

R01 NS39280 — 09/30/00-08/31/03
Radiosurgical Treatment of Temporal Lobe Epilepsy — $266,481 direct
NIH/NINDS (PI: Barbaro)

Award for Physics Residency Training Program — 09/01/96-08/31/98
ASTRO/AAPM (PI: Verhey) — $30,000 direct

PEER REVIEWED PUBLICATIONS

1. Abrams RJ, Abashian A, Mischke RE, Nefkens BMK, Smith JH, Thatcher RC, Verhey LJ, Wattenberg A. Test of time reversal invariance in the decay $K_L^\circ \rightarrow \pi^- \mu^+ \nu$. Phys Rev Letters 17:606-608, 1966.
2. Verhey LJ, Nefkens BMK, Abashian A, Abrams RJ, Carpenter DW, Mischke RE, Smith JH, Thatcher RC, Wattenberg A. Experimental investigation of CP violation in K_e3° decays. Phys Rev Letters 17:669-671, 1966.
3. Mischke RE, Abashian A, Abrams RJ, Carpenter DW, Nefkens BMK, Smith JH, Thatcher RC, Verhey LJ, Wattenberg A. Determination of the phase of the CP-nonconservation parameter η_{+-} in neutral K decay. Phys Rev Letters 18:138-141, 1967.
4. Thatcher RC, Abashian A, Abrams RJ, Carpenter DW, Mischke RE, Nefkens BMK, Smith JH, Verhey LJ, Wattenberg A. Upper limit on the decay rate $K_L^\circ \rightarrow \pi^+\pi^-\gamma$ Phys Rev. D4:1674-1680, 1968.
5. Abrams RJ, Abashian A, Mischke RE, Nefkens BMK, Smith JH, Thatcher RC, Verhey LJ, Wattenberg A. Muon polarization in K $\mu3^\circ$ meson decay. Phys Rev. D5:1603-1615, 1968.
6. Parsons ASL, Truoel P, Berardo PA, Haddock RP, Verhey LJ, Zeller ME. A scintillation counter array for detection of high energy neutrons. Nuc Inst and Methods 79:43-50, 1970.
7. Berardo PA, Haddock RP, Nefkens BMK, Verhey LJ, Zeller ME, Parsons ASL, Truoel P. Measurement of the $\pi^- p \rightarrow \gamma n$ differential cross section near the roper resonance, P_{11} (1460). Phys Rev Letters 24:419-422, 1970.
8. Berardo PA, Haddock RP, Nefkens BMK, Verhey LJ, Zeller ME, Parsons ASL, Truoel P. Measurement of inverse pion photoproduction near the $P_{33}\circ$ (1236) resonance. Phys Rev Letters 26:201-204, 1971.
9. Berardo PA, Haddock RP, Helland J, Nefkens BMK, Verhey LJ, Zeller ME, Parsons ASL, Truoel P. Analysis of negative pion photoproduction near the P_{33} resonance: test of the $\Delta I \leq 1$ rule and T-reversal invariance. Phys Rev Letters 26:205-208, 1971.
10. Berardo PA, Haddock RP, Nefkens BMK, Verhey LJ, Zeller ME, Parsons ASL, Truoel P. A measurement of the differential cross-section $\pi^- P \rightarrow n \pi^\circ$. Phys Rev D6:756-766, 1972.
11. Berardo PA, Haddock RP, Nefkens BMK, Verhey LJ, Zeller ME, Parsons ASL, Truoel P. Differential cross-sections of $\pi^- p \rightarrow \gamma n$ for 317, 452 and 491 MeV/c incident pion momentum. Phys Rev. D9:621-643, 1974.
12. Comiso JC, Blasberg DJ, Haddock RP, Nefkens BMK, Truoel P, Verhey LJ. Inverse pion photoproduction in the vicinity of the P_{33} (1232) resonance and a test of time reversal invariance. Phys Rev. D12:719-737, 1975.
13. Comiso JC, Blasberg DJ, Haddock RP, Nefkens BMK, Truoel P, Verhey LJ. Differential cross-section measurements of $\pi^- p \rightarrow \pi^\circ n$ around the P_{33} (1232) resonance. Phys. Rev. D12:738-743, 1975.
14. Loomis WA, Matis HS, Anderson HL, Bharadwaj VK, Booth NE, Fine RM, Francis WR, Gordon BA, Heisterberg RH, Hicks RG, Kirk TBW, Kirkbride GI, Mo LW, Myrianthopoulos LC, Pipkin RM, Pordes SH, Quirk SC. Inclusive hadron production in inelastic muon-proton scattering at 150 GeV/c. Phys Rev Letters 35:1483, 1975.

15. Weiss AJ, Blasberg DJ, Comiso JC, Haddock RP, Nefkens BMK, Verhey LJ, Zeller MB, Crowe KM, Fainberg A, Truoel P. Measurement of differential cross-sections for radiative pion-proton capture in the second resonance region. Nuc Phys. B101:1-18, 1975.
16. Anderson HL, Bharadwaj VK, Booth NE, Fine RM, Francis WR, Gordon BA, Heisterberg RH, Hicks RG, Kirk TBW, Kirkbride GI, Loomis WA, Matis HS, Mo LW, Myrianthopoulos LC, Pipkin FM, Pordes SH, Quirk SW, Shambroom WD, Skuja A, Verhey LJ, Williams WSC, Wilson R, Wright SC. Properties of inclusive hadron spectra in muon-nucleon scattering at 150 GeV/c. Phys Rev Letters 36:1422-1425, 1976.
17. Anderson HL, Bharadwaj VK, Booth NE, Fine RM, Francis WR, Gordon BA, Heisterberg RH, Hicks RG, Kirk TBW, Kirkbride GI, Loomis WA, Matis HS, Mo LW, Myrianthopoulos LC, Pipkin FM, Pordes SH, Quirk TW, Shambroom WD, Skuja A, Verhey LJ, Williams WSC, Wilson R, Wright SC. Measurement of nucleon structure function in muon scattering at 147 GeV/c. Phys Rev Letters 37:4-7, 1976.
18. Gragoudas ES, Goitein M, Koehler AM, Verhey LJ, Tepper J, Suit HD, Brockhurst R, Constable IJ. Proton irradiation of small choroidal malignant melanomas. Am J Ophthalmol. 83:665-673, 1977.
19. Francis WR, Anderson HL, Bharadwaj VK, Booth NE, Fine RM, Gordon BA, Heisterberg RH, Hicks RG, Kirk TBW, Kirkbride GI, Loomis WA, Matis HS, Mo LW, Myrianthopoulos LC, Pipkin FM, Pordes SH, Quirk TW, Shambroom WD, Skuja A, Verhey LJ, Williams WSC, Wilson R, Wright SC. Diffractive production of mesons by 147-GeV muons. Phys Rev Letters 38:633-636, 1977.
20. Anderson HL, Bharadwaj VK, Booth NE, Fine RM, Francis WR, Gordon BA, Heisterberg RH, Hicks RG, Kirk TBW, Kirkbride GI, Loomis WA, Matis HS, Mo LW, Myrianthopoulos LC, Pipkin FM, Pordes SH, Quirk TW, Shambroom WD, Skuja A, Staton MA, Williams WSC, Verhey LJ, Wilson R, Wright SC. Measurement of the proton structure function from muon scattering. Phys Rev Letters 38:1450-1454, 1977.
21. Tepper J, Verhey L, Goitein M, Suit HD, Koehler AM. In vivo determinations of RBE in a high energy modulated proton beam using normal tissue reactions and fractionated dose schedules. Int J Radiat Oncol Biol Phys. 2:1115-1122, 1977.
22. Suit H, Goitein M, Tepper J, Verhey L, Koehler A, Schneider R, Gragoudas E. Clinical experience and expectation with protons and heavy ions. Int J Radiat Oncol Biol Phys. 3:115-125, 1977.
23. Gragoudas E, Goitein M, Koehler A, Wagner M, Verhey L, Tepper J, Suit H, Schneider R, Johnson K. Proton irradiation of choroidal melanomas. Arch Ophthalmol. 96:1583-1591, 1978.
24. Gragoudas E, Goitein M, Koehler A, Wagner M, Verhey L, Tepper J, Suit H, Schneider R, Johnson K. Proton irradiation of malignant melanoma of the ciliary body. Brit J Ophthalmol. 63:135-139, 1979.
25. Shipley W, Tepper J, Prout G, Verhey L, Mendiondo O, Goitein M, Koehler A, Suit H. Proton radiation as boost therapy for localized prostatic carcinoma. JAMA 241:1912-1915, 1979.
26. Verhey L, Koehler A, McDonald J, Goitein M, Ma I-C, Schneider R, Wagner M. The determination of absorbed dose in a proton beam for purposes of charged particle radiation therapy. Radiat Res. 79:34-54, 1979.
27. Suit HD, Goitein M, Munzenrider JE, Verhey L, Gragoudas E, Koehler AM, Urano M, Shipley WU, Linggood RM, Friedberg C, Wagner M. Clinical experience with proton beam radiation therapy. J Canad Assoc Radiol. 31:35-39, 1980.

28. Gragoudas E, Goitein M, Verhey L, Munzenrider J, Suit H, Koehler A. Proton beam irradiation: an alternative to enucleation for intra-ocular melanomas. Ophthalmol. 87:571-581, 1980.
29. Urano M, Goitein M, Verhey L, Mendiondo O, Suit H, Koehler A. Relative Biological effectiveness of a high energy modulated proton beam using a spontaneous murine tumor in vivo. Int J Radiat Oncol Biol Phys. 6:1187-1193, 1980.
30. Munzenrider JE, Shipley WU, Verhey LJ. Future prospects of radiation therapy with protons. Sem Oncol. 8:110-124, 1981.
31. Shambroom WD, Gordon BA, Loomis WA, Pipkin FM, Pordes SH, Verhey LJ, Wilson R, Anderson HL, Fine RM, Heisterberg RH, Matis HS, Mo LW, Myrianthopoulos LC, Wright SC, Francis WR, Hicks WR, Kirk TBW, Bharadwaj VK, Booth NE, Kirkbride GI, Quirk TW, Skuja A, Williams WSC. Coherent production of mesons in muon-carbon scattering at 150 and 100 GeV. Phys Rev. 24:775-777, 1981.
32. Verhey LJ, Goitein M, McNulty P, Munzenrider JE, Suit HD. Precise positioning of patients for radiation therapy. Int J Radiat Oncol Biol Phys. 8:289-294, 1982.
33. Suit HD, Goitein M, Munzenrider J, Verhey L, Davis KR, Koehler A, Linggood R, Ojemann RG. Definitive radiation therapy for chordoma and chondrosarcoma of base of skull and cervical spine. J Neurosurg. 56:377-385, 1982.
34. Gragoudas ES, Goitein M, Verhey L, Munzenrider J, Urie M, Suit H, Koehler A. Proton beam irradiation of uveal melanomas: results of 5 ½ year study. Arch Ophthalmol. 100:928-934, 1982.
35. Goitein M, Abrams M, Gentry R, Urie M, Verhey L, Wagner M. Planning treatment with heavy charged particles. Int J Radiat Oncol Biol Phys. 8:2065-2070, 1982.
36. Suit HD, Goitein M, Munzenrider J, Verhey L, Blitzer P, Gragoudas E, Koehler AM, Urie M, Gentry R, Shipley W, Urano M, Duttenhaver J, Wagner M. Evaluation of the clinical applicability of proton beams in definitive fractionated radiation therapy. Int J Radiat Oncol Biol Phys. 8:2199-2205, 1982.
37. Duttenhaver JR, Shipley WU, Perrone T, Verhey LJ, Goitein M, Munzenrider JE, Prout GR, Kerr WS, Parkhurst EC, Suit HD. Protons or megavoltage x-rays as boost therapy for patients irradiated for localized prostatic carcinoma: an early phase I/II comparison. Cancer 51:1599-1604, 1983.
38. Verhey LJ, Sedlacek R. Determination of the radioprotective effects of topical applications of MEA, WR-2721 and N-acetylcysteine on murine skin. Radiat Res. 93:175-183, 1983.
39. Urano M, Verhey LJ, Goitein M, Tepper JE, Suit HD, Mendiondo O, Gragoudas ES, Koehler A. Relative biological effectiveness of modulated proton beams in various murine tissues. Int J Radiat Oncol Biol Phys. 10:509-514, 1984.
40. Gragoudas ES, Goitein M, Seddon J, Verhey L, Munzenrider J, Urie M, Suit HD, Blitzer P, Johnson KN, Koehler A. Preliminary results of proton beam irradiation of macular and paramacular melanomas. Brit J Ophthalmol. 68:479-485, 1984.
41. Gragoudas ES, Seddon J, Goitein M, Verhey L, Munzenrider J, Urie M, Suit HD, Blitzer P, Koehler A. Current results of proton beam irradiation of uveal melanomas. Ophthalmology 92:284-291, 1985.
42. Austin-Seymour M, Munzenrider JE, Goitein M, Gentry R, Gragoudas E, Koehler AM, McNulty P, Osborne E, Ryugo DK, Seddon J, Urie M, Verhey L, Suit HD. Progress in low LET heavy particle therapy: intracranial and paracranial tumors and uveal melanomas. Radiat Res. 104:S219-S226, 1985.

43. Seddon JM, Gragoudas ES, Polivogianis L, Hsieh CC, Egan KM, Goitein M, Verhey L, Munzenrider J, Austin-Seymour M, Urie M, Koehler A. Visual outcome after proton beam irradiation of uveal melanoma. Ophthalmol. 93:666-674, 1986.
44. Gragoudas ES, Seddon JM, Egan KM, Polivogianis L, Hsieh CC, Goitein M, Verhey L, Munzenrider J, Austin-Seymour M, Urie M, Koehler A. Prognostic factors for metastasis following proton beam irradiation of uveal melanomas. Ophthalmol. 93:675-680, 1986.
45. Petti PL, Verhey L, Wilson R. A measurement of w for 150 MeV protons in nitrogen and argon. Phys. Med. Biol. 31:1129-1138, 1986.
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49. Gragoudas ES, Seddon JM, Egan KM, Glynn RJ, Goitein M, Munzenrider J, Verhey L, Urie M, Koehler A. Metastasis from Uveal Melanoma after Proton Beam Irradiation. Ophthalmol. 95: 992-999, 1988.
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52. Munzenrider JE, Gragoudas E, Seddon J, Sisterson J, McNulty P, Birnbaum S, Johnson K, Austin-Seymour M, Slater J, Goitein M, Verhey L, Urie M, Ruotolo D, Egan K, Osuna F. Conservative treatment of uveal melanoma: probability of eye retention after proton treatment. Int. J. Radiat. Oncol. Biol. Phys. 15:553-558, 1988.
53. Slater JD, Austin-Seymour M, Munzenrider J, Birnbaum S, Carroll R, Klibanski A, Riskind P, Urie M, Verhey L, Goitein M. Endocrine Function Following High Dose Proton Therapy for Tumor of the Upper Clivus, Int. J. Radiat. Oncol. Biol. Phys. 15:607-611, 1988.
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55. Austin-Seymour M, Munzenrider J, Goitein M, Verhey L, Urie M, Gentry R, Birnbaum S, Ruotolo D, McManus P, Skates S, Ojemann R, Rosenberg A, Schiller A, Koehler A, Suit H. Fractionated proton radiation therapy of chordoma and low-grade chondrosarcoma of the base of the skull. J Neurosurg 70:13-17, 1989.
56. Rabin MSZ, Gottschalk B., Koehler A., Sisterson J., Verhey LJ. Compact designs for comprehensive proton beam clinical facilities. Nuclear Instruments and Methods in Physics Research B40/41: 1335-1339, 1989.
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1. Xia P, Pickett B, Vigneault E, Verhey LJ, Roach III M: Comparison of Intensity Modulated Treatment Plans for Multiple Dominant Intra-Prostatic Lesions of Prostate Cancer presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, Phoenix, AZ, 1998
2. Verhey L: IMRT with Conventional MLCs presented at the Annual Meeting of the American Association of Physicists in Medicine, Nashville, TN, 1999
3. Xia P, Wong G, Curran B, Verhey L: Dosimetric Aspects of Intensity Modulation in Serial Tomotherapy presented at the Annual Meeting of the American Association of Physicists in Medicine, Nashville, TN, 1999

4. Svatos M, Verhey L, Steinberg T: The Use of Multiple Static Fields to Smooth MLC Field Edges presented at the Annual Meeting of the American Association of Physicists in Medicine, Nashville, TN, 1999
5. Sultanem K, Shu HK, Xia P, Akazawa C, Quivey JM, Verhey LJ, Fu KK: 3-D Intensity Modulated Radiotherapy (IMRT) in the Treatment of Nasopharyngeal Carcinoma: The UCSF Experience presented at the Annual Meeting of the American Society of Therapeutic Radiology and Oncology, San Antonio, TX, 1999
6. Wieczorek DJ, Siantar CL, Descalle MA, Verhey LJ, Roach III M: The Effect of Tissue Heterogeneities and Dose Grid Resolution on Treatment Planning Dose Calculations presented at the Annual Meeting of the American Society of Therapeutic Radiology and Oncology, San Antonio, TX, 1999
7. Pirzkall A, Carol M, Pickett B, Roach III M, Verhey L: The Effect of Beam Energy and Number of Fields on Photon-Based IMRT for Deep Seated Targets presented at the Annual Meeting of the American Association of Physicists in Medicine, Chicago, IL, 2000
8. Xia P, Wong G, Somers J, Verhey L: Dosimetric Considerations in Step and Shoot IMRT Delivery presented at the Annual Meeting of the American Association of Physicists in Medicine, Chicago, IL, 2000
9. Verhey L: IMRT with Conventional MLCs presented at the Annual Meeting of the American Association of Physicists in Medicine, Chicago, IL, 2000
10. Smith V, Verhey L, Petti P: Comparison of 80% vs 50% Radiosurgery Dose Prescription Based on Biological Modeling presented at the Annual Meeting of the American Association of Physicists in Medicine, Chicago, IL, 2000
11. Graves E, Nelson S, Day M, Verhey L, Dillon W: Integration of Radiology and Radiation Oncology Data for Improved Clinical Management of Brain Tumor Patients presented at the Annual Meeting of the American Association of Physicists in Medicine, Chicago, IL, 2000
12. Descalle M, Chuang C, Daly T, Garrett D, Siantar CH, House R, May S, Patterson R, Walling R, Verhey L: Comparison of Portal Images and Images Simulated with Monte Carlo Methods presented at the Annual Meeting of the American Association of Physicists in Medicine, Chicago, IL, 2000
13. Svatos M, Rosenman J, Cullip T, Verhey L, Hughes J: Mixing Electrons with Intensity Modulated Photon Beams to Reduce Integral Dose presented at the Annual Meeting of the American Association of Physicists in Medicine, Chicago, IL, 2000
14. Chuang C, Xia P, Nguyen-Tan F, Fu K, Verhey L: Investigation of the Uncertainties in Patient Positioning and Patient Motion in IMRT Treatment presented at the Annual Meeting of the American Association of Physicists in Medicine, Chicago, IL, 2000
15. Descalle M, Wieczorek D, Daly T, Garrett D, Siantar CH, House R, May S, Patterson R, Walling R, Verhey L: Effects of Resolution and Statistical Noise on Monte Carlo Simulations of Radiation Therapy presented at the Annual Meeting of the American Association of Physicists in Medicine, Chicago, IL, 2000
16. Svatos MM, Rosenman JG, Verhey LJ: Effectiveness of Mixing Electrons with Intensity Modulated Photons for Reduction of Integral Dose for a Variety of Tumor Sizes and Depths presented at the Annual Meeting of the American Society of Therapeutic Radiology and Oncology, Boston, MA, 2000
17. Lee JS, Verhey LJ, Smith V, Petti PL, Lamborn KR, Larson DA, Wara WM, McDermott M, Sneed PK: Quantitative Description of Dose Conformality Achieved by Gamma Knife Radiosurgery Compared to Linac Radiosurgery presented at the Annual Meeting of the American Society of Therapeutic Radiology and Oncology, Boston, MA, 2000

18. Pirzkall A, Larson DA, McKnight TR, Graves EE, Nelson SJ, Verhey LJ: MR-Spectroscopy Results in Improved Target Delineation for High-Grade Gliomas presented at the Annual Meeting of the American Society of Therapeutic Radiology and Oncology, Boston, MA, 2000
19. Pouliot J, Aubin M, Chuang C, Pickett B, Roach III M, Verhey L: Clinical Use of an A-Si Flat Panel for Megavoltage Portal Imaging at UCSF presented at the Annual Meeting of the American Association of Physicists in Medicine, Salt Lake City, UT, 2001
20. Verhey L: IMRT with Multileaf Collimators presented at the Annual Meeting of the American Association of Physicists in Medicine, Salt Lake City, UT, 2001
21. Walling R, Daly T, Siantar CH, Faddegon B, Bielajew A, Chuang C, Verhey L: Dosimetric Accuracy of the PEREGRINE Monte Carlo Dose Calculation System for Photon Beams presented at the Annual Meeting of the American Association of Physicists in Medicine, Salt Lake City, UT, 2001
22. Chuang C, Wang L, Verhey L, Xia P: Investigation of the Use of MOSFET for Routine Clinical Dosimetric Verification presented at the Annual Meeting of the American Association of Physicists in Medicine, Salt Lake City, UT, 2001
23. Pirzkall A, Smith V, Hoess A, Lohr F, Sneed P, Larson D, Verhey L: Radiosurgery with Gamma Knife (GK) or Linac Based Micro-MLC (mMLC) for Irregular Targets: Evaluation of Physical Dose Characteristics presented at the Annual Meeting of the American Association of Physicists in Medicine, Salt Lake City, UT, 2001
24. Smith V, Pirzkall A, Hoess A, Lohr F, Sneed P, Larson D, Verhey L: Radiosurgery with Gamma Knife (GK) or Linac Based Micro-MLC (mMLC) for Irregular Targets: Evaluation Based on Complication and Control Probabilities presented at the Annual Meeting of the American Association of Physicists in Medicine, Salt Lake City, UT, 2001
25. Hwang A, Verhey L, Xia P: Using a Leaf Sequencing Algorithm to Enlarge Treatment Field Length in IMRT presented at the Annual Meeting of the American Association of Physicists in Medicine, Salt Lake City, UT, 2001
26. Poon I, Lee N, Akazawa P, Quivey JM, Verhey L, Xia P: Optimal dose/volume constraints of sensitive structures in inverse planning for nasopharyngeal carcinoma presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, San Francisco, CA, 2001
27. Nakamura JL, Pirzkall A, Carol M, Xia P, Smith V, Wara WM, Petti PL, Verhey LJ, Sneed PK: Comparison of intensity modulated radiosurgery to Gamma Knife for challenging skull base lesions presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, San Francisco, CA, 2001
28. Pirzkall A, Takahashi M, McKnight TR, Graves EE, Nelson SJ, Verhey LJ, Larson DA, Sneed PK: Metabolic imaging by means of 3D MR-Spectroscopy for low-grade gliomas presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, San Francisco, CA, 2001
29. Xia P, Chuang C, Akazawa P, Phillips TL, Quivey JM, Verhey L, Lee N: Methods of reducing skin toxicity due to extened-field intensity-modulated radiation therapy (EF-IMRT) for the treatment of head and neck cancers presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, San Francisco, CA, 2001
30. Pouliot J, Aubin M, Verhey L, Bani-Hashemi A, Mitschke M, Hernandez P, Hughes J: Low dose megavoltage CT cone beam reconstruction for patient alignment presented at the Annual Meeting of the American Association of Physicists in Medicine, Montreal, Quebec, 2002

31. Chuang C, Woodruff D, Verhey L, Xia P: Investigation of the dosimetric consequences of leaf setting uncertainties for a double-focused MLC in IMRT delivery presented at the Annual Meeting of the American Association of Physicists in Medicine, Montreal, Quebec, 2002
32. Xia P, Yu N, Xing L, Verhey L: Investigation of a variable power objective function for inverse planning optimization in IMRT presented at the Annual Meeting of the American Association of Physicists in Medicine, Montreal, Quebec, 2002
33. Langen K, Pouliot J, Anezinos C, Aubin M, Hsu I, Gottschalk A, Lowther D, Shinohara K, Verhey L, Roach M: Inter-user variability of the BAT ultrasound system presented at the Annual Meeting of the American Association of Physicists in Medicine, Montreal, Quebec, 2002
34. Pirzkall A, Li X, Larson DA, Verhey LJ, Nelson SJ: MR-spectroscopy imaging for resected high-grade gliomas prior to radiation therapy: Tumor extent according to metabolic activity in relation to MRI presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, New Orleans, LA, 2002
35. Xia P, Liu Y, Poon I, Akazawa P, Quivey J, Verhey LJ, Lee N: Development of a standard set of dose constraints to sensitivie structures in treatment of nasopharyngeal cancers using inverse planned IMRT presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, New Orleans, LA, 2002
36. Chuang C, Xia P, Akazawa P, Verhey L, Quivey JM, Lee N: Comparison of three treatment techniques involving IMRT fields for head and neck cancers presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, New Orleans, LA, 2002
37. Langen K, Pouliot J, Anezinos C, Aubin M, Gottschalk AR, Hsu I, Lowther D, Shinohara K, Weinberg V, Verhey LJ, Roach M: Evaluation of the use of the BAT ultrasound system for prostate localization and repositioning: an inter-user study presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, New Orleans, LA, 2002
38. Akazawa C, Akazawa P, Lee N, Quivey J, Verhey L, Xia P: Forward-planned treatment techniques using multisegments for head and neck cancer presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, New Orleans, LA, 2002
39. Pouliot J, Xia P, Aubin M, Verhey L, Langen K, Bani-Hashemi A, Svatos M, Ghelmansarai F, Mitchke M: Dose-guided radiation therapy using low-dose megavoltage cone-beam CT presented at the Annual Meeting of the American Association of Physicists in Medicine, San Diego, CA, 2003
40. Chuang C, Curran B, Verhey L: Clinical implementation and validation of a commercial Monte Carlo dose calculation system presented at the Annual Meeting of the American Association of Physicists in Medicine, San Diego, CA, 2003
41. Lee M, Pirzkall A, Akazawa P, Verhey LJ, Nelson SJ: MR Spectroscopy of radiation effects in healthy brain tissue following radiotherapy presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, Salt Lake City, UT, 2003
42. Pouliot J, Xia P, Aubin M, Verhey L, Bani-Hashemi A, Ghelmansarai F, Mitschke M, Svatos M: Low-dose megavoltage cone-beam CT for dose-guided radiation therapy presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, Salt Lake City, UT, 2003
43. Lee N, Zhu N, Baker L, Shin EJ, Quivey JM, Phillips TL, Verhey L, Xia P: Intra-fraction patient motion in head/neck cancer patients undergoing intensity-modulated radiation therapy (IMRT) presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, Salt Lake City, UT, 2003

44. Park C, Lee N, Kim Y, Quivey JM, Phillips TL, Verhey LJ, Xia P: A method to account for dose fractionation by using a modified equivalent uniform dose algorithm presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, Salt Lake City, UT, 2003
45. Aubin M, Roach M, Verhey L, Pouliot J: Clinical acceptance of the flat panel for megavoltage portal imaging at UCSF: Three year experience presented at the Annual Meeting of the American Association of Physicists in Medicine, Pittsburgh, PA, 2004
46. Aubin M, Pouliot J, Milender L, Shinohara, K, Pickett B, Anezinos C, Verhey L, Roach M: Daily prostate targeting with implanted gold markers and an a-Si flat panel EPID at UCSF: A Five year clinical experience presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, Atlanta, GA, 2004
47. Lometti M, Thurston D, Aubin M, Verhey L, Lockhart JM, Bland R, Roach M, Pouliot J: Are lateral electronic portal images adequate on-line daily targeting of the prostate? Results of a prospective study presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, Atlanta, GA, 2004
48. Chen H, Xia P, Verhey L, Roach III M: Dosimetric consequences to the pelvic lymph nodes due to the daily motion of the prostate presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, Atlanta, GA, 2004
49. Xia P, Hsu I-C, Speight J, Zytkovicz A, Gottschalk A, Verhey L: Two isocenter treatment technique for pelvic malignancies with positive pelvic and para-aortic lymph nodes using intensity modulated fields presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, Atlanta, GA, 2004
50. Gao M, Perks JR, Kubo HD, Luo C, Skubic SE, Verhey LJ, Smith V, Goetsch SJ, Araki F: The application of newly developed glass rod dosimeter in the quality assurance and dosimetric audit of Gamma Knife presented at the Annual Meeting of the American Society for Therapeutic Radiology and Oncology, Atlanta, GA, 2004

RESEARCH PROGRAM

FIVE SIGNIFICANT RECENT PUBLICATIONS:

1. Xia P, Verhey LJ. MLC leaf sequencing algorithm for intensity modulated beams with multiple static segments. Medical Physics 25(8): 1424-1434, 1998

   As senior author, I worked closely with Dr. Xia to develop the most efficient general method of leaf segmentation for intensity modulated radiotherapy. This method has been generally accepted by other investigators in the field as the gold standard of leaf segmentation algorithms.

2. Graves EE, Pirzkall A, Nelson SJ, Verhey LJ, Larson DA: Registration of magnetic resonance spectroscopic imaging to computed tomography for radiotherapy treatment planning. Med. Phys. 28(12): 2489-2496, 2001

   As senior technical author, I developed the data transfer and data verification system for overlaying the Gamma Knife dose distributions from the planning system on the MRSI images as required for accurate correlation of clinical outcome with radiosurgery dose.

3. Xia P, Hwang AB, Verhey LJ: A leaf sequencing algorithm to enlarge treatment field length in IMRT. Med. Phys. 29(6): 991-998, 2002

   As senior author, I provided the technical guidance to fully understand the problems with the clinical leaf sequencing algorithm and to devise a method to avoid undeliverable sequences through the development of a new computer algorithm.

4. Langen KM, Pouliot J, Anezinos C, Aubin M, Gottschalk AR, Hsu I-C, Lowther D, Liu Y-M, Shinohara K, Verhey LJ, Weinberg V, Roach III M: Evaluation of ultrasound-based prostate localization for image-guided radiotherapy. Int J Radiat Oncol Biol Phys. 57(3): 635-644, 2003

   As senior technical author, I was heavily involved in the design of the experimental questions and the analysis and interpretation of the data that made this highly controversial and important paper publishable. This study was seminal in showing the superior accuracy of direct radiographic visualization of radiopaque markers in the prostate compared to ultrasound localization.

5. Xia P, Lee N, Liu YM, Poon I, Weinberg V, Shin E, Quivey JM, Verhey LJ: A study of planning dose constraints for treatment of nasopharyngeal carcinoma using a commercial inverse treatment planning system. Int J Radiat Oncol Biol Phys 59(3): 886-896, 2004

   As senior author, I provided guidance, technical advice and encouragement as well as diplomatic editing that were needed to get this excellent paper published. This paper describes the ultimate method of efficient inverse planning of tumors of the head and neck with intensity modulated radiotherapy (IMRT) and has been responsible for making IMRT of .head and neck lesions available to a larger fraction of patients.

CURRENT RESEARCH INTERESTS

1. Precision Radiotherapy.

I am working to improve the applicability, efficiency and safety of intensity modulated x-ray beam treatments (IMRT), planned either with conventional 3DCRT planning programs or inverse treatment planning programs. I have developed collaborations between UCSF and the vendors of these planning programs (NOMOS, Philips) and delivery systems (Siemens) through which we are optimizing the clinical use of IMRT.

Precision treatments require accurate positioning of patient anatomy and accurate localization of the target within the patient on a daily basis. New methods of patient immobilization, position verification and target localization are being developed. The locations of imbedded radiopaque markers are being routinely detected on a daily basis with electronic portal imagers and manually compared with calculated positions from the treatment plan prior to treatment. Work is uderway to automate the detection, comparison and required couch motions to allow precise daily positioning of prostate tumors.

The next challenge in positioning is accurate dose delivery to targets that move with respiration. I am establishing a collaboration with a vendor that manufactures implantable radiofrequency transmitters that can be stimulated by external antennas and located by triangulation in real time. I am interested in using this information to move the patient couch or the beam-defining collimator leaves, to keep the target at the treatment isocenter during all phases of the respiratory cycle.

2. Image- and dose-guided radiotherapy

In collaboration with Siemens, we are pursuing the acquisition and manipulation of reconstructed 3D images using a series of images taken rapidly with an electronic portal imager at different gantry angles. These images can be compared with the treatment planning CT on a daily or weekly basis for patient position verification. These 3D images can also be used as a basis for daily analysis of delivered dose. I am working with other faculty and graduate students to develop a method of using this information in an efficient manner to improve the quality of the dose actually delivered to each patient by adjusting treatment plans during a course of treatment if the daily imaging proves that it is necessary.

3. Functional imaging to assist tumor identification.

I am working with other faculty in Radiation Oncology and Radiology to evaluate the use of biological information in the definition of tumor for radiotherapy targeting. Magnetic Resonance Spectroscopy (MRSI) is proving very useful in defining areas of active tumor in prostate and brain. In addition, a state-of-the-art PET-CT scanner is being installed at UCSF in China Basin before the end of 2004.This unit will have the highest spatial resolution currently available for PET information and promises to be extremely helpful in identifying active areas of tumor, particularly for patients with head and neck lesions. I am working to find the best method of transferring and displaying this information for Radiation Oncologists and in evaluating the impact of both PET-CT and MRSI technologies on tumor control.